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The Mental Health and Behavioral Consequences of Terrorism

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The behavioral consequences of terrorist incidents have received considerable recent attention, much of it driven by the 1995 Oklahoma City bombings and the attacks of September 11, 2001, in the United States. In this chapter we will review the available evidence about the mental health and behavioral consequences of terrorism, consider methodological and research issues that challenge the field, and discuss the evidence for specific prevention and treatment efforts aimed at mitigating the mental health and behavioral consequences of terrorism.

Terrorism is psychological warfare, and behavioral disturbance is the primary intent of terrorists (Alexander, 2005). As Lenin stated, "The object of terrorism is to terrorize," and as long ago as the 4th century B.C.E.

Sun Tzu advised, "Kill one to terrorize ten thousand" (Beare, Burrows, & Merrett, 1978). The more incomprehensible the event, the greater the potential mental health effects. Human intent, as seen in terrorist incidents, may be associated with the greatest risk of behavioral disturbance (Norris, Friedman, & Watson, 2002).

Definitions of terrorism vary (Butler, Panzer, & Goldfrank, 2003). According to the United States Department of State, terrorism is "premeditated, politically motivated violence perpetrated against non-combatant targets by sub-national groups or clandestine agents usually intended to influence an audience" (Atran, 2003). A broader definition, proposed by public health practitioners, states that it is "the intentional use of violence—real

or threatened—against one or more non-combatants and/or those services essential for or protective of their health, resulting in adverse health effects in those immediately affected and their community, ranging from a loss of well-being or security to injury, illness, or death" (Arnold & Birnbaum, 2003).

Neither definition captures the sense of chilling brutality associated with what is commonly accepted as terrorism. Perhaps closer to the mark is an evocative description of terrorist violence in Northern Ireland: "One atrocity provoked another, equally inhumane and gruesome, and the whole 20-year history has been pockmarked by some particular incidents of quite indescribable cruelty as man has visited his inhumanity upon his fellow man in some utterly barbaric ways" (Curran, 1988). It is notable that, prior to 1964, Northern Ireland was "one of the most peaceful societies in Europe," with only one murder reported in Belfast between 1960 and 1964 (Curran, 1988).

The intended consequences of terrorist acts extend beyond those immediately affected.

Exposure may be defined in terms of physical proximity to incidents, level of threat, and personal loss or injury to family or friends (Herman, Felton, & Susser, 2002). For example, 2,795 people were killed at the World Trade Center as a result of the September 11, 2001, terrorist attacks; an additional 7,467 persons were injured. The two groups together had 17,642 family members. A total of 17,859 were exposed to the attack as were 32,361 employees and their 87,383 family members (Herman et al., 2002). All told, 164,710 persons were directly exposed to this terrorist attack. For every individual killed, an additional 59 persons were traumatized (Figure 9.1). An additional 4,800,000 residents of the surrounding 10 counties, in ways large and small, coped with the events of that day. It should be no surprise, then, that 20% of New York City residents living below Canal Street, in proximity to the events, met the criteria for post-traumatic stress disorder (PTSD) at some point in the two-month period following September 11, 2001 (Galea et al., 2002). Analogously, the 467 terrorist deaths
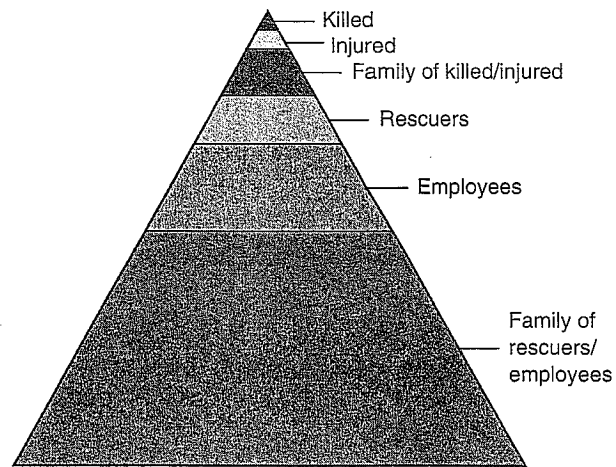

Figure 9.1   Relative Proportion of Persons Affected by Trauma of September 11, 2001, New York City World Trade Center Terrorist Attacks

in Northern Ireland in 1972 directly or indirectly affected an additional 27,000 people, or 18 per 1,000 of the population (Curran, 1988). The 472 deaths attributed to the intifada in Israel in the 19 months between 2000 and 2003, affected 4 persons per 1,000 of the population (Bleich, Gelkopf, & Solomon, 2003).

POSTTRAUMATIC STRESS DISORDER

PTSD is likely the most prevalent and debilitating consequence of disasters, in general, and terrorism, in particular (Galea, Nandi, & Vlahov, 2005). There is an emerging consensus in the literature both that PTSD is a likely outcome of terrorism incidents, and that PTSD after such events is frequently accompanied by other behavioral and health disturbances (Galea et al., 2005). Although the behavioral consequences of terrorist incidents have received considerable recent attention—much of it driven by the Oklahoma City bombings and the attacks of September 11, 2001, in the United States—most of the information on disaster-related PTSD comes from the general disaster literature. Of the 160 studies included in a recent meta-analysis of postdisaster psychiatric disturbance, only 8 specifically addressed terrorism (Norris, Friedman, Watson, et al., 2002).

First described in the 1980s and included in the *Diagnostic and Statistical Manual, Third Edition* (*DSM–III*), the diagnosis of PTSD arose largely in response to the experiences of war veterans (APA, 1982). To qualify for a diagnosis, an individual required at least one eligible traumatic event (a "criterion A" stressor), a symptom of reexperiencing the trauma (intrusion), a numbing or blunting of affect (avoidance), and at least two symptoms of hypervigilance and startling (arousal). The diagnostic criteria underwent revision in the *DSM–III–R* (APA, 1987), when the requirement of at least one month's duration was added and again, and in *DSM–IV* (APA, 1994), when the individual's perception of the event was added to the criteria.

The work impairment associated with PTSD is as great or greater than it is in major depressive disorder, and PTSD is associated with increased rates of medical utilization (Lovejoy, Diefenbach, Licht, & Tolin, 2003). The general population rate of PTSD has been estimated between 5.4% (Lovejoy et al., 2003) and 7.8% (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995). Left untreated, PTSD is thought to last between 36 to 64 months, but can persist for as long as a decade; time to remission can be reduced by half with treatment (Lovejoy et al., 2003; North, 2002). Over the course of a lifetime, one half of the general population will meet a "Criteria A" stressor at some point; about one third of these individuals will develop PTSD (North, 2002).

Reports of the prevalence of PTSD among victims of manmade disasters vary greatly. Rates are highest for victims and survivors, from 25% of individuals exposed to a 1991 Killeen, Texas, mass shooting up to 75% of individuals in a 1988 oil rig fire. Prevalence rates among rescuers vary from 5% to 40%. Approximately 13% of Oklahoma City firefighters met criteria for PTSD several months later. Nearly half of the Australian firefighters involved in battling a bush fire in 1993 had PTSD at some point in the first two years following the incident. The prevalence of PTSD in the general population after a disaster is lower. Between 7% and 11% of New York City residents met criteria for PTSD after September 11, 2001, and 9% of Alaskans were reported to have PTSD after the Exxon Valdez incident (Galea et al., 2005).

In the first weeks following the September 11, 2001, terrorist attacks, 1 in 10 New York area residents met the criteria for PTSD (Marshall & Galea, 2004). There were

estimates that 520,000 people in New York City (NYC) and the surrounding areas would experience symptoms of PTSD and that 129,000 would seek treatment (Herman et al., 2002). Nearly 8% of NYC residents reported using mental health services in the 30-day period five months after September 11 (Boscarino et al., 2004). A year later, NYC residents continued to be "very concerned" about future terrorist attacks (Boscarino, Figley, & Adams, 2003).

Although the number of studies that has considered PTSD after terrorism specifically is limited, one review of the topic suggested that in the year following terrorist incidents, the prevalence of PTSD in directly affected populations varies between 12% and 16% and that this prevalence can be expected to decline 25% over the course of that year (DiMaggio & Galea, 2006). In contrast, some researchers have found evidence of persistently elevated prevalence of psychological distress many months after and at long distances from the events of September 11, 2001 (Silver, Holman, McIntosh, Poulin, & Gil-Rivas, 2002). There is also evidence of resilience in the face of terrorism (Lovejoy et al., 2003; Satel, 2003). Among U.S. military veterans, there was no significant increase in the utilization of mental health services for the treatment of PTSD in the NYC area (Rosenheck & Fontana, 2003b), and among a national sample of veterans with a preexisting diagnosis of PTSD, there was, in fact, evidence of less severe symptoms on admission after September 11, 2001, than before (Rosenheck & Fontana, 2003a).

CORRELATES OF PTSD

Gender and prior psychiatric diagnoses are strongly associated with subsequent PTSD and may be useful triage factors for outreach or treatment, particularly when taken together with such variables as direct exposure to events as either a survivor or rescuer.

In one review, 94% of these studies that looked at gender found that being female was associated with an increased risk of postdisaster behavioral health disturbance (Norris, Friedman, & Watson, 2002), with women reported as being twice as likely to develop PTSD (North, 2002). Marriage and parenthood are also associated with increased risk (Norris, Friedman, Watson, et al., 2002). Taken together, these associations point to the potential common mediating factor of an imbalance of resources or the stress of caring for others and being obligated to provide more resources than are received (Norris, Friedman, & Watson, 2002).

Although minority status and lower socioeconomic status are associated with increased risk of postdisaster behavioral diagnoses, this is likely attributable, at least in part, to increased risk of exposure (Norris, Friedman, Watson, et al., 2002). For example, after the events of the September 11, 2001, terrorist attacks, NYC residents of lower socioeconomic status were 2.5 times more likely to develop PTSD (Galea et al., 2002), and there were reports of increased alcohol and tobacco use among drug users, although there was no change in heroin or cocaine use (Factor et al., 2002).

Particularly relevant to acts of terrorism, human intent underlying a disaster has been associated with increased risk of behavioral disturbances, compared with natural disaster (Norris, Friedman, & Watson, 2002). Kidnappings and torture are associated with the highest rates of PTSD, and flooding is associated with the lowest (North, 2002). Severe behavioral effects are also seen in which there is extreme and intensive property damage, serious and ongoing financial problems, or a high prevalence of trauma and death (Norris, Friedman, & Watson, 2002). In NYC after the September 11, 2001, terrorist attacks, those who lived closest to the World Trade Center area had a three times greater risk of developing PTSD (Galea et al., 2002). Deaths

are not necessary for there to be behavioral health effects (Norris, Friedman, Watson, et al., 2002); for example, 43% of residents near the Exxon Valdez disaster had psychiatric impairments.

Loss of psychosocial resources, such as family, friends, and jobs as well as relocation and disruption of neighborhood patterns may be key mediators of postterrorism behavioral disturbances, and preexisting psychiatric conditions predispose individuals to postdisaster PTSD (Norris, Friedman, Watson, et al., 2002). Although associations with media exposure have been reported, many of these studies are cross-sectional, and the direction of the association is unclear.

Risk for developing postterrorism PTSD varies by age, with an increase during school age, followed by a second, more prominent increase during middle age (Norris, Friedman, Watson, et al., 2002). In a study of PTSD among 7,000 children seven weeks after the bombing in Oklahoma City, physical, interpersonal, and TV exposure accounted for 12% of variance, and peri-traumatic response alone accounted for 25%. The authors concluded that a child's subjective response to trauma is a key predictor of PTSD and should be included in the diagnostic criteria for PTSD in children (Pfefferbaum, Doughty, et al., 2002).

Studies of children most often report symptoms rather than diagnoses, which may account, in part, for such high rates as the reported 95% of children who had symptoms of PTSD after the Armenian earthquakes (Galea et al., 2005). In one study of the psychological sequelae of the September 11, 2001, terrorist attacks, there was a 46% increase in the diagnosis of PTSD in children in the following months, compared with the previous months. The increase for adults was 12%. Notably, there was no increase in the diagnosis of depression or substance abuse (Hoge, Pavlin, & Milliken, 2002).

Violence, such as terrorism, is associated with the highest level of mental health disturbances in children, but the relative impact of different kinds of exposures varies (Herman et al., 2002). Kuwaiti children were relatively unaffected by interpersonal exposure during the Gulf War, but those whose friends were killed in a non-war-related bus crash were (Pfefferbaum, Doughty, et al., 2002). Half of the children exposed to Hurricane Andrew were reported to have a new onset behavioral disorder; 33% had PTDS, and 56% of children in high-impact areas were impaired two months after the event (Norris, Friedman, Watson, et al., 2002).

OTHER POSTDISASTER BEHAVIOR

Other postterrorism behavioral disturbances are reported to varying degrees. There were a reported 99 hate crimes against Middle Easterners in the United States in the month following the September 11, 2001, terrorist attacks, compared with 93 such crimes in all of 2001 and 12 in 2000 (Swahn et al., 2003). Some of this increase may be attributed to increased surveillance. There was no increase in divorces following the Oklahoma City bombing (Nakonezny, Reddick, & Rodgers, 2004). Postterrorism alcohol use among military veterans with a preexisting diagnosis of PTSD has been shown to increase, but has not been demonstrated among civilians (Pfefferbaum, Vinekar, et al., 2002).

There are reports from war zones that patients with depressive disorders, obsessive-compulsive disorders, and phobias may show symptomatic improvement as a result of a traumatic experience (Curran, 1988). According to one researcher, citing the British experience during the Long Blitzkrieg of World War II and the U.S. experience during the race riots of the 1960s, "Civil disorder can paradoxically have a beneficial psychological effect possibly through collective forces including increasing social cohesion" (Curran, 1988). Another researcher noted a 50% decline in the suicide rate as well as a decrease

in stress-related "lichen planus" in Northern Ireland between 1969 and 1975, which is regarded as evidence of resiliency (Beare et al., 1978). Yet another investigator cites the nationwide decline, in the United States, in chronic fatigue syndrome following the September 11, 2001, terrorist attacks (Heim, Bierl, Nisenbaum, Wagner, & Reeves, 2004). According to this line of reasoning, some individuals will invariably develop psychiatric illness after being subjected to or witnessing trauma, but many in the general population may actually improve psychologically: "The general population (of Northern Ireland) . . . is largely unaffected from the psychiatric point of view . . . [and] whilst the victims of violence do suffer emotional reactions . . . those reactions are often comparatively short-lived" (Curran, 1988). However, much of the evidence about the behavioral consequences of terrorism and mass violence is unclear, such as the conflicting reports on the effect of the September 11 terrorist attacks on suicide rates (De Lange & Neeleman, 2004; Salib, 2003), and resilience in the face of terror must be balanced against the growing literature on medically unexplained symptoms and physical diagnoses following terrorism and disasters.

Medically unexplained symptoms are "physical symptoms that provoke care seeking but have no clinically determined pathogenesis" (Clauw et al., 2003). Research suggests that at least one third of the symptoms in both clinical and population-based studies are medically unexplained (Clauw et al., 2003). At times, these constellations of symptoms are characterized as physical and, at other times, as primarily psychological. This may have more to do with the background, training, and prior assumptions of the investigators than with the illness itself (Clauw et al., 2003). However, it is rare to have a truly new disease; similar constellations of symptoms are given new names based on the event from which they arose

(Clauw et al., 2003). Such syndromes have followed vaccination programs for U.S. and U.K. military personnel and have been a prominent feature of Gulf War syndrome among U.S. troops. Other instances include Canadian troops concerned about exposure to "red soil" in Croatia, a so-called Balkan War syndrome attributed to exposure to depleted uranium, a "mystery syndrome" after a jetliner crashed into a populated area of Amsterdam, and "jungle fever" among Dutch peacekeepers in Cambodia in the 1980s (Peterson, Nicolas, McGraw, Engler, & Blackman, 2002).

The noninjury physical diagnoses reported following disasters have often been cardiac in nature. There was a greater than threefold increase in myocardial infarctions in Japan following the Honshin Awerjuu earthquake (Qureshi, Merla, Steinberg, & Rozanski, 2003). This was attributed to increased hematocrit, fibrinogen, and other coagulation factors, with the elderly perhaps most at risk (Qureshi et al., 2003). In animal models, acute stress decreases the arrhythmia threshold by up to 40%. This effect has been shown to be interrupted by the administration of beta blockers (Qureshi et al., 2003).

METHODOLOGICAL AND RESEARCH ISSUES

Although the field of postdisaster research is burgeoning, there remain many questions, as suggested by the review discussed earlier, and substantial methodological challenges that need to be overcome in future research. Approximately two thirds of disaster-related behavioral studies are cross-sectional (Norris, Friedman, Watson, et al., 2002). Such studies are likely to pick up more long-standing cases of disease and may explain, at least in part, reports of extended chronicity (North, McCutcheon, Spitznagel, & Smith, 2002). Studies that have attempted a longitudinal approach, although often based on two data

points, have demonstrated rapid declines in PTSD prevalence over time (Norris, Friedman, Watson, et al., 2002). Most of these latter studies are prospective, although retrospective approaches, such as interrupted time series analyses, may yield informative results as well (Nakonezny et al., 2004).

The majority of postdisaster studies are individual level rather than ecologic. The observations of cross-community differences in responses to terrorist events, such as the September 11, 2001, terrorist attacks, suggest that ecologic studies may play an important role in assessing the determinants of population mental and behavioral heath after disasters and terrorism (Silver, 2004). Postterrorism studies are likely to detect other non-disaster-related chronic conditions. For example, approximately half of the Oklahoma City firefighters in one sample met lifetime criteria for alcohol abuse or dependency (North, Tivis, et al., 2002). The vast majority (90%) of the one sample of children studied after the 1998 U.S. embassy bombing in Kenya were deemed exposed to other crimes or human-caused violence (Pfefferbaum, North, et al., 2003). This complicates the task of assessing the health problems that were caused by exposure to the disaster or terrorist attack. The exposure under study may also be confounded by other events that occurred during the same time period. For example, the 2001 attacks on the World Trade Center were quickly followed by both anthrax-laced mail attacks and a passenger jet crash.

Resource utilization may be particularly difficult to measure during times of crisis. Fear of violence may cause people to stay home, decreasing hospitalization numbers (Beare et al, 1978). Psychiatric admission rates may not capture successful outpatient treatments, and there may be changes in available services over time. Some psychiatric conditions may be overshadowed by physical complaints (Curran, 1988).

PTSD continues to be a focus of research attention after disasters and terrorism, perhaps to the detriment of other behavioral disorders. In one review of all postdisaster behavioral research, 68% of studies addressed PTSD, 36% included major depressive disorder, and 20% included generalized anxiety (Norris, Friedman, Watson, et al., 2002). Behavioral diagnoses such as alcohol abuse and somatic disorders are not commonly studied (Norris, Friedman, Watson, et al., 2002). But changes in diagnostic and screening instruments for PTSD over time (APA, 1982, 1987, 1994) and the myriad screening instruments available for assessing PTSD (Blake et al, 1995; Blanchard, Jones-Alexander, Buckley, & Forneris, 1996; Breslau, Davis, Peterson, & Schultz, 1997; Horowitz, Wilner, & Alvarez, 1979; Lindal & Stefansson, 1993) make comparisons difficult even within the same geographic region. The number of studies conducted worldwide bear little resemblance to the overall risk of disaster and terrorism. Figure 9.2 shows the number of postterrorism behavioral health studies conducted since 1980, compared with the number of reported terrorist incidents in the region (Significant Terrorist Incidents, 2004).

PREVENTION, TREATMENT, AND RESILIENCE

Ascribing suicide terrorism to individual characteristics may be misattributing the primary causes of terrorism (Attran, 2003). Psychopathology, poverty, and lack of education also are not reliable indicators of whom may become a terrorist: "Suicide terrorists have no appreciable psychopathology and are at least as educated and economically well off as their surrounding populations" (Attran, 2003). In fact, there may be a slight positive correlation with education, and although relative economic loss may be a factor, there is no real association with poverty. The only distinguishing characteristics of suicide bombers are that they tend to be single, male, and religious (Attran, 2003). This, then, suggests that preemptive screening and identification of persons who might
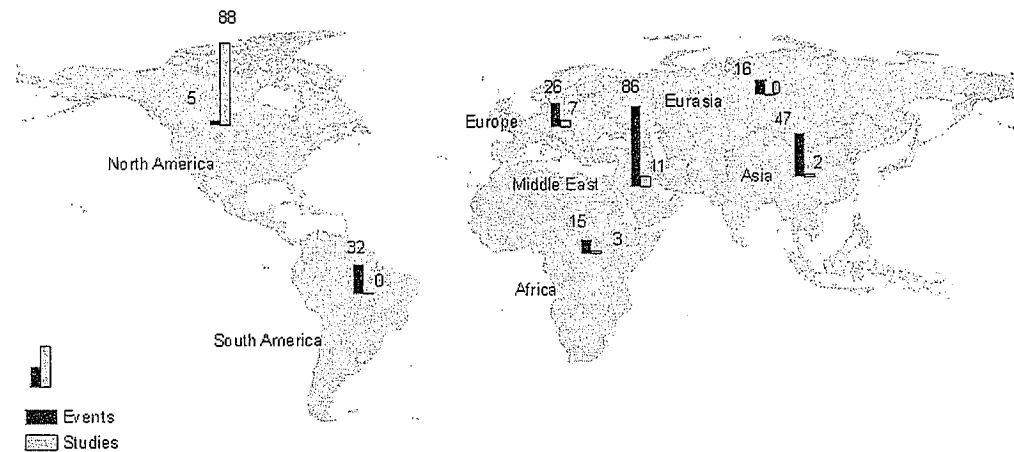
Figure 9.2   Comparison of Proportion of Postterrorism Behavioral Health Studies (Grey) to
               Proportion of Reported Terrorist Incidents (Black) Since 1980 by Region of the World

SOURCE: Reprinted from DiMaggio and Galea (2006).

become terrorists may be impossible. It has been argued that interventions are needed at the community (ecologic) level. An effective approach may be to target moderates within a community and address issues of discontent so as to encourage the communities themselves to abandon support for terrorist activities (Attran, 2003). Although this is intuitively appealing, the scant data on the evolution of terrorism make it difficult to muster the empirical evidence to support such sweeping recommendations. Therefore our relatively limited armamentarium of empirically validated measures to prevent terrorism suggests that it is incumbent on policymakers to consider ways to mitigate the potential consequences of terrorism and not simply focus on preventing terrorism.

Primary prevention of behavioral health effects among first responders may be feasible in the form of training as well as control of the postterrorist environment. The mental health effects of disasters on recovery workers can be mitigated by training and experience (Norris, Friedman, Watson, et al., 2002). Training must be tailored to the type of likely exposure. Firefighters and other first responders are exposed to personal risk, medical workers must confront death and horror, and counselors risk vicarious trauma (Norris, Friedman, & Watson, 2002). Rescuers with realistic expectations of what to expect may experience fewer behavioral breakdowns (Clauw et al., 2003). It has been shown that soldiers with higher rank and esprit de corps exhibit fewer behavioral problems during times of war and that isolated support troops sometimes have higher rates of illness than frontline forces (Clauw et al., 2003). Cultivating a culture of collegiality and common purpose may also control postdisaster pathology.

Individual pre-event screening among the civilian population may look for individuals at risk of developing behavioral symptoms and offer early treatment. Once identified, interventions may include cognitive-behavioral therapy (Clauw et al., 2003). However, studies about the predictive power of screening instruments and the cost-effectiveness of individual versus community-level interventions are limited.

Secondary prevention, in the forms of early identification and quick intervention is

also possible. The onset of PTSD is fairly early after an incident, so interventions should start early with triage to identify those most at risk due to preexisting psychiatric disease and other risk factors such as proximity to the event (North, 2002). There is little evidence to endorse any particular treatment approach. While there have been no randomized clinical trials of postdisaster behavioral interventions (Peterson et al, 2002), there is no evidence that critical stress debriefing is effective (Clauw et al., 2003; Peterson et al., 2002), although identifying high-risk individuals and providing several sessions of cognitive-behavioral therapy can prevent PTSD (Clauw et al., 2003). There have been few studies of the effects of drug regiments (Norris, Friedman, & Watson, 2002). Interventional trials with drugs that have an acceptable safety profile, such as beta blockers, may be warranted.

Because most individuals experiencing medically unexplained symptoms will get better spontaneously (Clauw et al., 2003), public health messages reminding people that most symptoms will resolve may be helpful. Efforts should be directed at symptom management and not at the establishment of a hard diagnosis (Clauw et al., 2003). It is important, however, on both the individual and community levels to avoid trivializing people's concerns.

Perceptions of self-efficacy may be a key to resilience. "What matters, apparently, is not so much how people actually cope, but rather how they perceive their capacities to cope and control outcomes" (Norris, Friedman, Watson, et al., 2002). Resilience may reside as much in the community as in the individual. Resource dynamics "undoubtedly account for the overall resilience many, if not most, people show in the face of-even quite serious stress" (Norris, Friedman, & Watson, 2002). Collective interventions should replace valued resources as quickly as possible, emphasize self-empowerment, and reinforce indigenous networks. If relocation is necessary, people should be kept in natural groups and be encouraged to return to normal activities as soon as possible (Norris, Friedman, & Watson, 2002).

Community and neighborhood interventions such as public education, capacity building, and a return to normalcy probably should receive higher priority than individual interventions (Norris, Friedman, & Watson, 2002). Disasters are characterized by a loss of community services just at the time they are most needed (Norris, Friedman, & Watson, 2002). Social support can be defined as both the perceived support and the goods and services that are actually delivered. Interventions thought to be effective "improve community cohesion[,] . . . provide appropriate direction and high quality leadership[,] . . . and build a sense of individual responsibility and control" (Clauw et al., 2003).

TERRORIST-RELATED PHYSICAL INJURY

Despite concern over chemical, radiological, and biological attacks, the majority of direct terrorist-related physical injury to date has been the result of direct trauma. While many terror-related injuries tend to be of greater severity than non-terror-related injuries and are characterized by penetrating wounds and the consequences of explosions, there are often a large proportion of persons with minor injuries.

An Israeli review of a pediatric population found that 54% of 138 children injured due to terrorist activity had the highest injury severity score (25+), compared with 3% of 8,363 non-terror-injured children. The terrorist-related injuries were significantly more likely to require a higher degree of critical care, more likely to involve penetrating injuries to the torso or open head wounds, and more likely to involve internal injuries (Aharonson-Daniel, Waisman, Dannon, & Peleg, 2003). In Bologna, Italy, in 1980, 73 of 291 casualties died at the scene of the terrorist bomb explosion.

Morbidity was characterized by primary blast injuries such as so-called blast lung and flash burns as well as secondary injuries such as concussions, lacerations, and factures (Brismar & Bergenwald, 1982).

Terrorist-related injuries are more likely to involve gunshot wounds and explosives than non-terrorist-related injuries. In a one-year period between 1993 and 1994, one Israeli hospital reported treating 220 terrorist-related injuries. While more than half the patients (54%) were injured by thrown projectiles and stones, a fourth (25%) had been shot, and 10 patients (4.5%) were injured by explosives (Emile & Hashmonai, 1998).

These kinds of injuries are labor and resource intensive and exact a great toll on healthcare systems. During a 15-month period between 2000 and 2001, 2.4% (561) of all trauma admissions to nine acute-care Israeli hospitals were for terrorist-related injuries. Three fourths of patients were in their twenties and male. Forty eight percent of injuries were due to explosions, and 47% due to gunshot wounds. The authors concluded that the severity of injuries required a greater level of critical care from that seen in non-terrorist-related injuries and imposed a significant burden on the Israeli health care system (Peleg, Aharonson-Daniel, Michael, & Shapira, 2003).

Researchers have attempted to pool terrorist-related injuries to describe overall patterns. One such study combined 3,357 casualties from 220 worldwide terrorist incidents and found an immediate fatality rate of 13%. Nearly one third of survivors were hospitalized, of whom, 1.4% died. The authors concluded that discriminating triage could decrease overall survival (Frykberg & Tepas, 1988). A meta-analysis of 29 terrorist bombings concluded that most of the 903 deaths among the 8,634 casualties were immediate and untreatable. Penetrating soft-tissue injuries (41% to 86%) predominated, followed by pulmonary injuries (1% to 21% of survivors) depending on the environment (closed or open space) in which the bombing occurred (Arnold, Halpern, Tsai, & Smithline, 2004).

Many injuries are immediately fatal, but the majority of survivors will suffer less significant trauma. During a four-and-a-half-year period from 1975 to 1979, one Jerusalem hospital reported 272 terrorist-related hospital admissions, the majority of which (87%) were graded as "light" according to a commonly used "injury severity score." Only 10% of injuries were considered severe (Adler, Golan, Golan, Yitzhaki, & Ben-Hur, 1983). A 1978 British study of 1,532 consecutive terrorist bombing victims found only nine deaths in hospital (Hadden, Rutherford, & Merrett, 1978). More recent events have borne out this experience. For example, 759 persons sustained injuries after the 1995 Oklahoma City bombing: 167 persons died, 83 survivors were hospitalized. Survivors' injuries were characterized by soft-tissue trauma, such as lacerations and sprains (Mallonee et al., 1996). Following the events of September 11, 2001, in NYC, two nearby hospitals treated approximately 900 patients, of whom 85% were "walking wounded" sustaining ocular injuries and lacerations. A total of 135 patients were admitted to hospital, of whom 18 required surgery (Cushman, Pachter, & Beaton, 2003). Of the 970 recorded injuries to rescue and nonrescue workers on that day in New York, 49% involved inhalation injuries followed by ocular injuries (26%) and minor soft-tissue trauma, such as sprains and contusions (14%) and lacerations (14%; Rapid Assessment, 2002).

Injury research and control in general deserves greater attention and resources. Although injury is the number one killer of 1- to 34-year-olds in the United States (Rivara, Grossman, & Cummings, 1997) and results in more potential years of life lost than cancer and cardiovascular disease combined (Meyer, 1998), for every dollar spent on cancer research, the federal government spends about 11 cents for injury research (Robertson, 1998).

Despite its seemingly random nature, injuries, including those due to terrorism, are far from chance events and can be fitted to predictive models. Once adequately described, there is every reason to expect that terrorist-related injuries are at the very least amenable to secondary and tertiary public health interventions.

Many questions remain to be answered (CDC, 2005). What are the types, prevalence, and incidence of fatal and nonfatal injuries? What are the demographic characteristics, including race, ethnicity, and socioeconomic status, of affected individuals? What are the best means of transport, and what are the most effective treatments? What resources will be needed and how will they affect surge response? This kind of information is crucial for medical and public health professionals and community planners and policy makers to prepare for the possibility of terrorist incidents.

CONCLUSIONS

Effective postterrorist public health interventions require the recognition that behavioral consequences are, in fact, the intent of terrorists. The behavioral consequences of terrorist incidents have received considerable recent attention, much of it driven by the Oklahoma City bombings and the attacks of September 11, 2001, in the United States. PTSD is the most commonly studied psychopathology after disasters. Survivors of terrorist incidents consistently suffer the highest rates of PTSD; rescuers and first responders are at next highest risk. Prevalence estimates of disorders, such as PTSD, may mask great variability, depending on who is being studied, who is conducting the study, and where the event occurred.

It appears that terrorism-related behavioral diagnoses, such as PTSD, apply also to victims of natural disasters. The accumulated evidence on interventions following natural disasters is likely to be appropriate for the postterrorist environment. The presence of previous psychiatric diagnoses is strongly associated with subsequent PTSD and may be a useful triage factor, particularly when taken into consideration with such factors as female gender and direct exposure to events as either a survivor or rescuer. These associations are consistent among study types and environments and are important variables to consider when developing triage, outreach, and treatment programs.

Although most people in the general population can be expected to recover spontaneously within several months to a year from natural and unnatural disasters, there are potential population-level interventions to perhaps facilitate and speed the process. These include recognition of honest appraisals of behavioral health effects in community health announcements; preserving, as much as possible, community, family, and social networks; and returning individuals to normal activities as soon as feasible. Finally, some individuals such as survivors, rescuers, and those with a psychiatric history are at increased risk of conditions, such as PTSD, and may require individual interventions. These persons should be identified and referred for treatment. The physical injuries associated with terrorism are characterized by immediately fatal and severe injuries in those most directly exposed to the event, and a greater number of minor injuries for those more peripherally exposed. However, many questions remain to be answered about how best to utilize health care resources in response to terrorism.

REFERENCES

Adler, J., Golan, E., Golan, J., Yitzhaki, M., & Ben-Hur, N. (1983). Terrorist bombing experience during 1975–79: Casualties admitted to the Shaare Zedek Medical Center. *Israel Journal of Medical Sciences, 19*(2), 189–193.

Aharonson-Daniel, L., Waisman, Y., Dannon, Y. L., & Peleg, K. (2003). Members of the Israel Trauma G: Epidemiology of terror-related versus non-terror-related traumatic injury in children. *Pediatrics, 112*(4), e280.

Alexander, D. (2005, May 18). *Psychological aspects of terrorism.* Paper presented at 14th World Congress on Disaster and Emergency Medicine, Edinburgh, Scotland.

American Psychiatric Association. (1982). *Desk reference to the diagnostic criteria from DSM–III.* Washington, DC: Author.

American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed., rev.). Washington, DC: Author.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

Arnold, J. L., & Birnbaum, M. L. (2003, April–June). A proposed universal medical and public health definition of terrorism. *Prehospital and Disaster Medicine, 18*(2), 47–52.

Arnold, J. L., Halpern, P., Tsai, M. C., & Smithline, H. (2004). Mass casualty terrorist bombings: A comparison of outcomes by bombing type. *Annals of Emergency Medicine, 43*(2), 263–273.

Atran, S. (2003, March 7). Genesis of suicide terrorism. *Science, 299,* 1534–1539.

Beare, J. M., Burrows, D., & Merrett, J. D. (1978). The effects of mental and physical stress on the incidence of skin disorders. *British Journal of Dermatology, 98*(5), 553–558.

Blake, D. D., Weathers, F. W., Nagy, L. M., Kaloupek, D. G., Gusman, F. D., Charney, D. S., et al. (1995, January). The development of a Clinician-Administered PTSD Scale. *Journal of Traumatic Stress, 8,* 75–90.

Blanchard, E. B., Jones-Alexander, J., Buckley, T. C., & Forneris, C. A. (1996, August). Psychometric properties of the PTSD Checklist (PCL). *Behaviour Research and Therapy, 34,* 669–673.

Bleich, A., Gelkopf, M., & Solomon, Z. (2003). Exposure to terrorism, stress-related mental health symptoms, and coping behaviors among a nationally representative sample in Israel. *JAMA, 290*(5), 612–620.

Boscarino, J. A., Figley, C. R., & Adams, R. E. (2003). Fear of terrorism in New York after the September 11 terrorist attacks: Implications for emergency mental health and preparedness. *International Journal of Emergency Mental Health, 5*(4), 199–209.

Boscarino, J. A., Galea, S., Adams, R. E., Ahern, J., Resnick, H., & Vlahov, D. (2004, March). Mental health service and medication use in New York City after the September 11, 2001, terrorist attack. *Psychiatric Services, 55,* 274–283.

Breslau, N., Davis, G. C., Peterson, E. L., & Schultz, L. (1997, January). Psychiatric sequelae of posttraumatic stress disorder in women. *Archives of General Psychiatry, 54,* 81–87.

Brismar, B., & Bergenwald, L. (1982). The terrorist bomb explosion in Bologna, Italy, 1980: An analysis of the effects and injuries sustained. *Journal of Trauma-Injury Infection & Critical Care, 22*(3), 216–220.

Butler, A. S., Panzer, A. M., & Goldfrank, L. R. (2003). Preparing for the psychological consequences of terrorism a public health strategy. Washington, DC: National Academies Press. Retrieved January 20, 2006, from http://site.ebrary.com/lib/yale/Doc?id=10046858

Centers for Disease Control (CDC). (n.d). Mass trauma preparedness and response. Retrieved November 14, 2005, from www.cdc.gov/masstrauma/research/possible_studies/medical_clinical/rapid_assessment.htm

Clauw, D. J., Engel, C. C., Jr., Aronowitz, R., Jones, E., Kipen, H. M., Kroenke, K., et al. (2003, October). Unexplained symptoms after terrorism and war: An expert consensus statement. *Journal of Occupational and Environmental Medicine, 45,* 1040–1048.

Curran, P. S. (1988, October). Psychiatric aspects of terrorist violence: Northern Ireland, 1969–1987. *British Journal of Psychiatry, 153,* 470–475.

Cushman, J. G., Pachter, H. L., & Beaton, H. L. (2003, January). Two New York City hospitals' surgical response to the September 11, 2001, terrorist attack in New York City. *Journal of Trauma, 54,* 147–154; discussion 147–154.

De Lange, A. W., & Neeleman, J. (2004, Winter). The effect of the September 11 terrorist attacks on suicide and deliberate self-harm: A time trend study. *Suicide and Life-Threatening Behavior, 34,* 439–447.

DiMaggio, C., & Galea, S. (2006). The behavioral consequences of terrorism: A meta-analysis. *Academic Emergency Medicine, 13,* 559–566.

Emile, H., & Hashmonai, D. (1998). Victims of the Palestinian uprising (Intifada): A retrospective review of 220 cases. *Journal of Emergency Medicine, 16*(3), 389–394.

Factor, S. H., Wu ,Y., Monserrate, J., Edwards, V., Cuevas, Y., Del Vechio, S., et al. (2002, September). Drug use frequency among street-recruited heroin and cocaine users in Harlem and the Bronx before and after September 11, 2001. *Journal of Urban Health, 79,* 404–408.

Frykberg, E. R., & Tepas, J. J., III. (1988). Terrorist bombings: Lessons learned from Belfast to Beirut. *Annals of Surgery, 208*(5), 569–576.

Galea, S., Nandi, A., & Vlahov, D. (2005, July 1). The epidemiology of post-traumatic stress disorder after disasters. *Epidemiologic Reviews, 27,* 78–91.

Galea, S., Resnick, H., Ahern, J., Gold, J., Bucuvelas, M., Kilpatrick, D., et al. (2002, September). Posttraumatic stress disorder in Manhattan, New York City, after the September 11th terrorist attacks. *Journal of Urban Health, 79,* 340–353.

Hadden, W. A., Rutherford, W. H., & Merrett, J. D. (1978). The injuries of terrorist bombing: A study of 1532 consecutive patients. *British Journal of Surgery, 65*(8), 525–531.

Heim, C., Bierl, C., Nisenbaum, R., Wagner D., & Reeves, W. C. (2004, September–October). Regional prevalence of fatiguing illnesses in the United States before and after the terrorist attacks of September 11, 2001. *Psychosomatic Medicine, 66,* 672–678.

Herman, D., Felton, C., & Susser, E. (2002, September). Mental health needs in New York State following the September 11th attacks. *Journal of Urban Health, 79,* 322–331.

Hoge, C. W., Pavlin, J. A., & Milliken, C. S. (2002, August 8). Psychological sequelae of September 11. *New England Journal of Medicine, 347,* 443–445.

Horowitz, M., Wilner, N., & Alvarez, W. (1979, May). Impact of event scale: A measure of subjective stress. *Psychosomatic Medicine, 41,* 209–218.

Kessler, R. C., Sonnega, A., Bromet, E., Hughes, M., & Nelson, C. B. (1995, December 1). Posttraumatic stress disorder in the National Comorbidity Survey. *Archives of General Psychiatry, 52,* 1048–1060.

Lindal, E., & Stefansson, J. G. (1993, July). The lifetime prevalence of anxiety disorders in Iceland as estimated by the U.S. National Institute of Mental Health Diagnostic Interview Schedule. *Acta Psychiatrica Scandinavica, 88,* 29–34.

Lovejoy, D. W., Diefenbach, G. J., Licht, D. J., & Tolin, D. F. (2003). Tracking levels of psychiatric distress associated with the terrorist events of September 11, 2001: A review of the literature. *Journal of Insurance Medicine, 35*(2), 114–124.

Mallonee, S., Shariat, S., Stennies, G., Waxweiler, R., Hogan, D., & Jordan, F. (1996). Physical injuries and fatalities resulting from the Oklahoma City bombing. *JAMA, 276*(5), 382–387.

Marshall, R. D., & Galea, S. (2004). Science for the community: Assessing mental health after 9/11. *Journal of Clinical Psychiatry, 65*(Suppl. 1), 37–43.

Meyer, A. A. (1998, January). Death and disability from injury: A global challenge. *Journal of Trauma, 44,* 1–12.

Nakonezny, P. A., Reddick, R., & Rodgers, J. L. (2004, February). Did divorces decline after the Oklahoma City bombing? *Journal of Marriage & Family, 66,* 90–100.

Norris, F. H., Friedman, M. J., & Watson, P. J. (2002, Fall). 60,000 disaster victims speak: Part II. Summary and implications of the disaster mental health research. *Psychiatry, 65,* 240–260.

Norris, F. H., Friedman, M. J., Watson, P. J., Byrne, C. M., Diaz, E., & Kaniasty, K. (2002, Fall). 60,000 disaster victims speak: Part I. An empirical review of the empirical literature, 1981–2001. *Psychiatry, 65,* 207–239.

North, C. S. (2002, March). Psychiatric effects of disasters and terrorism: Empirical basis from study of the Oklahoma City bombing. Paper presented at American Psychopathological Association, Fear and anxiety: The benefits of translational research. Retrieved September 14, 2006, from http://ajp.psychiatryonline.org/cgi/content/full/162/1/200

North, C. S., McCutcheon, V., Spitznagel, E. L., & Smith, E. M. (2002, September). Three-year follow-up of survivors of a mass shooting episode. *Journal of Urban Health, 79,* 383–391.

North, C. S., Tivis, L., McMillen, J. C., Pfefferbaun, B., Spitznagel, E. L., Cox, J., et al. (2002, May). Psychiatric disorders in rescue workers after the Oklahoma City bombing. *American Journal of Psychiatry, 159,* 857–859.

Peleg, K., Aharonson-Daniel, L., Michael, M., & Shapira, S. C. (2003). Israel Trauma G: Patterns of injury in hospitalized terrorist victims. *American Journal of Emergency Medicine, 21*(4), 258–262.

Peterson, A. L., Nicolas, M. G., McGraw, K., Englert, D., & Blackman, L. R. (2002, September). Psychological intervention with mortuary workers after the September 11 attack: The Dover Behavioral Health Consultant model. *Military Medicine, 167*(Suppl. 9), 83–86.

Pfefferbaum, B., Doughty, D. E., Reddy, C., Patel, N., Gurwitch, R. H., Nixon, S. J. et al. (2002, September). Exposure and peritraumatic response as predictors of posttraumatic stress in children following the 1995 Oklahoma City bombing. *Journal of Urban Health, 79,* 354–363.

Pfefferbaum, B., North, C. S., Doughty, D. E., Gurwitch, R. H., Fullerton, C. S., & Kyula, J. (2003, April). Posttraumatic stress and functional impairment in Kenyan children following the 1998 American embassy bombing. *American Journal of Orthopsychiatry, 73,* 133–140.

Pfefferbaum, B., Vinekar, S. S., Trautman, R. P., Lensgraf, S. J., Reddy, C., Patel, N., et al. (2002, June). The effect of loss and trauma on substance use behavior in individuals seeking support services after the 1995 Oklahoma City bombing. *Annals of Clinical Psychiatry, 14*(2), 89–95.

Qureshi, E. A., Merla, V., Steinberg, J., & Rozanski, A. (2003, January). Terrorism and the heart: Implications for arrhythmogenesis and coronary artery disease. *Cardiac Electrophysiology Review, 7,* 80–84.

Rapid assessment of injuries among survivors of the terrorist attack on the World Trade Center—New York City, September 2001. (2002, January 11). *Morbidity and Morality Weekly Report, 51,* 1–5.

Rivara, F. P., Grossman, D. C., & Cummings, P. (1997, August 21). Injury prevention: First of two parts. *New England Journal of Medicine, 337,* 543–548.

Robertson, L. S. (1998). *Injury epidemiology: Research and control strategies* (2nd ed.). New York: Oxford University Press.

Rosenheck, R. A., & Fontana, A. (2003a). Post-September 11 admission symptoms and treatment response among veterans with post-traumatic stress disorder. *Psychiatric Services, 54*(12), 1610–1617.

Rosenheck, R., & Fontana, A. (2003b). Use of mental health services by veterans with PTSD after the terrorist attacks of September 11. *American Journal of Psychiatry, 160*(9), 1684–1690.

Salib, E. (2003, September). Effect of 11 September 2001 on suicide and homicide in England and Wales. *British Journal of Psychiatry, 183,* 207–212.

Satel, S. (2003, December). The mental health crisis that wasn't. *Psychiatric Services, 54,* 1571.

Significant terrorist incidents, 1961–2003: A brief chronology. (2004). Retrieved August 16, 2005, from www.state.gov/r/pa/ho/pubs/fs/5902.htm

Silver, R. (2004, Spring). Conducting research after the 9/11 terrorist attacks: Challenges and results. *Families, Systems, & Health, 22,* 47–51.

Silver, R. C., Holman, E. A., McIntosh, D. N., Poulin, M., & Gil-Rivas, V. (2002, September 11). Nationwide longitudinal study of psychological responses to September 11. *JAMA, 288,* 1235–1244.

Swahn, M. H., Mahendra, R. R., Paulozzi, L. J., Winston, R. L., Shelley, G. A., Taliano, J., et al. (2003). Violent attacks on Middle Easterners in the United States during the month following the September 11, 2001 terrorist attacks. *Injury Prevention, 9*(2), 187–189.